Department of Energy
National Nuclear Security Administration
Office of the General Counsel
P. O. Box 5400
Albuquerque, NM 87185

May 9, 2019

FEDEX DELIVERY – CONFIRMATION RECEIPT REQUESTED

Joseph Durso
MuckRock News/Dept MR 72612
411A Highland Ave.
Somerville, Massachusetts 02144-2516

Dear Mr. Durso:

This letter is the final response to your May 2, 2019, Freedom of Information Act (FOIA) request for:

Your request stated the following:

Requesting the "retention letter" referred to on page 41 of GAO report # GAO-14-449 (https://www.gao.gov/assets/662840.pdf) associated with the retention of "canned subassemblies" of an unspecified warhead for potential use in defending the earth against asteroids, including any original appendices or other attachments.

We contacted the Sandia Field Office (SFO) to conduct a search for records pertaining to your request. SFO requested that Sandia National Laboratory (SNL) conduct a search for responsive records. National Technology & Engineering Solutions of Sandia, LLC (NTESS) conducted a thorough search and found no responsive records to the request. Searches were completed in the following area(s) of NTESS:

Record Information Management personnel at Sandia National Laboratories conducted a search of archived email and documents, and the Digital Archive in ElMS FileNet using a variation of keywords as stated in the FOIA request: asteroid, near earth object, planetary defense, Y-12. No responsive records were located. All departments that might plausibly be expected to have responsive records at Sandia National Laboratories conducted a search and found no responsive records.

We contacted the National Nuclear Security Administration (NNSA) Office of Defense Programs (NA-10) to conduct a search for responsive records pertaining to your request. NA-10 searched and located 3 responsive records:

- 2014 NNSA Planetary Defense Initiative Memo Response, August 25, 2014, (7 Pages).
- 2014 Planetary Defense Cook Memo, Finding Flexibility in Site Budgets to Support Planetary Defense Initiative, May 1, 2014, (2 Pages).
- 2015 End of Planetary Defense Memo, W71 Canned Subassembly (CSA), July 9, 2015, (1 Page).

We contacted the National Nuclear Security Administration (NNSA) Production Office, Y-12 (NPO, Y-12) and Consolidated Nuclear Security, LLC (CNS) to conduct a search for responsive records pertaining to your request. NNSA Production Office (NPO, Y-12) and Consolidated Nuclear Security, LLC (CNS) searched and located 1 responsive record. The document has been reviewed by the NPO Classification Officer who determined that the document contains no classified information or unclassified controlled nuclear information.

- W71 Canned Subassembly (CSA) Director, Stockpile Programs Memo, July 29, 2015, (1 Page).

The enclosed CD contains the responsive documents which are fully releasable in their entirety.

There are no fees chargeable to you for processing this request. If you have questions please contact Mr. Roberto Marquez by e-mail at Roberto.Marquez@nnsa.doe.gov, or write to the address above. Please reference Control Number FOIA 19-00191-R.

Sincerely,

John Weckerle
Authorizing Official

Enclosure

date: August 25, 2014

to: Kevin Greenough
Planetary Defense Program Manager

from: Mike Haertling, Los Alamos National Laboratory
Keith Matzen, Sandia National Laboratories
Des Pilkington, Lawrence Livermore National Laboratory

subject: NNSA Planetary Defense Initiative

The NNSA National Laboratories are willing and able to respond to Dr. Cook's request for support of the newly formed NNSA Planetary Defense Initiative (PDI), as stated in the May 1, 2014 Memo titled "Finding Flexibility in Site Budgets to Support Planetary Defense Initiative".

The labs embrace the vision that Dr. Cook presented at the NNSA meeting on January 31,2014, which consists of developing a strong technical basis that explores the potential role of nuclear devices deflecting asteroids. We concur that this work should progress over the next 5-7 years, should be collaborative in nature with both national and international partners, where possible, and be published in the open literature in order to enable sound technical challenges. We also believe that this activity could demonstrate a more general role of Stockpile Stewardship Program (SSP) tools in this endeavor, regardless of whether the mitigation technique is nuclear or non-nuclear. Finally, the labs have observed the opportunity this activity may provide for exercising nuclear device design skills for a new application as well as for mentoring new design staff in the use of the SSP tools.

The initial lab goals for the effort are five-fold:

a) Assess, and develop where appropriate, SSP tools for the PDI application
b) Apply tools to a series of case studies in collaboration with NASA, starting with Case Study 1 (see Annex for description)
c) Subject to political approval, collaborate with Russia on a series of international comparisons, starting with a simplification of Case Study 1, called Asteroid Deflection Test Problem 1 (see reference LLNL-MI-652658 for definition)
d) Investigate the effectiveness of US nuclear designs for PDI and assess potential design modifications *for greater effectiveness*
e) Consider the engineering challenges associated with delivering a nuclear package for such an application

We note that although some of this work will be classified, results will be submitted for open publication, as applicable, with a commitment to work towards a joint publication with NASA by December 2015 (subject to successful collaborations with NASA).

The record of engagement on the topic by the three NNSA labs stretches back decades, involving a small but dedicated set of individuals who have employed their knowledge and lab capabilities to various aspects of the problem. Indeed in the early 1990's, members of the laboratories participated in a series of workshops (including one held at Los Alamos) that were documented as a volume of the Space Science Series titled "Hazards Due to Comets and Asteroids." Over the subsequent twenty years, effort has been almost entirely by individual initiative, yet today there are a range of established, internationally recognized technical experts at each of the labs who are engaged in the problem, support U. S. Government exercises, participate in a range of collaborations, publish their work, and are generally active in the planetary-defense community. The work performed, including more recent focused activity covers a broad range of activities from anticipating the engineering and qualification issues to interactions of nuclear outputs with the asteroid to modeling meteoroid airbursts in the Earth's atmosphere. The labs are able to staff the PDI, and require only the requested flexibility with Defense Programs. It is expected, and technically reasonable, that the tool assessment and design studies will be more active initially than the engineering considerations. The detailed scope adjustments are being discussed with Defense Programs but for FY15 the integrated effort will be no more than 5.5 FTEs (~2.25 FTE for each of LANL/LLNL and ~1 FTE for SNL) with the exact effort expended being responsive to Defense Program priorities during the year. Support will be maintained for any Post-Docs dedicated to this effort.

Funding will be leveraged through DSW and the Science and ASC Campaigns, primarily through redirected work on materials properties, common modelling, and reductions in Advanced Certification activities.

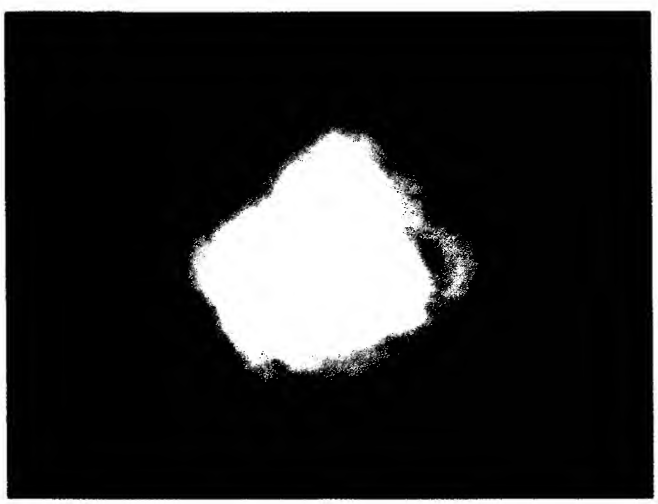
The management effort is being overseen at the laboratories by Michael Haertling (LANL), Keith Matzen (SNL) and Des Pilkington (LLNL). It is proposed that the tri-lab technical leader/coordinator for the NNSA PDI be Paul Miller (LLNL).

Mike Haertling	Keith Matzen	Des Pilkington
Los Alamos National Laboratory	Sandia National Laboratories	

Annex: Discussion of Case Study 1: Bennu (also known as 1999 RQ_{36})

Case Study 1 adopts the asteroid Bennu for study in a hypothetical impact scenario. Adjusting the asteroid's position so that an impact will occur, the Case Study aims to assess the problem in an integrated manner, from discovery time, through mission development, launch, intercept, and finishing with deflection scenarios. An assessment of the adequacy of chosen actions will be made, including the consequence of partial failure where a fragment, with mass one tenth of one percent of Bennu, enters the Earth's atmosphere. The results will be influenced by uncertainties in the characterization of the asteroid's properties. While the relative closing speed between Bennu and the earth is low (6.36 km/s), falling into the earth's gravitational potential well results in an impact speed of 12.86 km/s, and an impact energy of 2.7 Gigatons.

As one of the best-characterized asteroids that has not been visited, and with the coming Osiris Rex mission, Bennu offers an outstanding opportunity to study the mitigation uncertainty associated with asteroid characterization. Mass, composition, bulk density (porosity) all contribute to uncertainty in the speed change that will result from a deflection attempt. Shape, rotation, and structural inhomogeneity further exacerbate the challenge of predicting the consequences of most mitigation proposals. Bennu's Earth-like orbit brings it within radar range every 5 or 6 years, resulting in a shape model, and a very well determined orbit. Orbital deviations from the expected gravitational path are attributable to non-gravitational forces, and provide data that can be interpreted for a mass and bulk density. This is much more precise data than is usually available for an asteroid. Additional characterization resulting from Osiris Rex will provide a measure of the mitigation uncertainty to be assigned to even the best observed asteroids



Bennu is a large (492+/- 20 m sphere equivalent), but relatively low density (0.958 +/- 0.130 g/cc) Asteroid.

Period (rotation)	= 4.288 Hr
Dmean (sphere equivalent)	= 492+/- 20 m
Density (Bulk)	= 0.958 +/- 0.130 g/cc
M (Chesley)	= 5.97 X10^{10} Kg

Asteroid deflection is first dependent on discovery and recognition as a threat. Discovered in 1999, Bennu has one of the highest impact risk probabilities (Sentry System list), for a range of dates 150-170 years in the future. This risk is dependent on a set of very close passages between 2060 and 2128 for which non-gravitational forces (like the Yarkovsky Effect) will be a determinant. With only normal optical monitoring, it would be very difficult to know that Bennu is a threat more than 40 years prior to impact. This is a long enough period to consider a range of mitigation options that decrease rapidly as the time shortens. Chief among the early options will be one or more massive impactors. Later, deflection or disruption using nuclear explosives is possible. The time at which nuclear explosives become the only option is influenced by characterization uncertainty.

Mass is the next critical element in determining the momentum that must be coupled into the body to effect a deflection. Only a tiny percentage of the known Near Earth Objects (NEOs) have data providing an estimate of the mass and bulk density. Here again, Bennu is unusually well characterized.

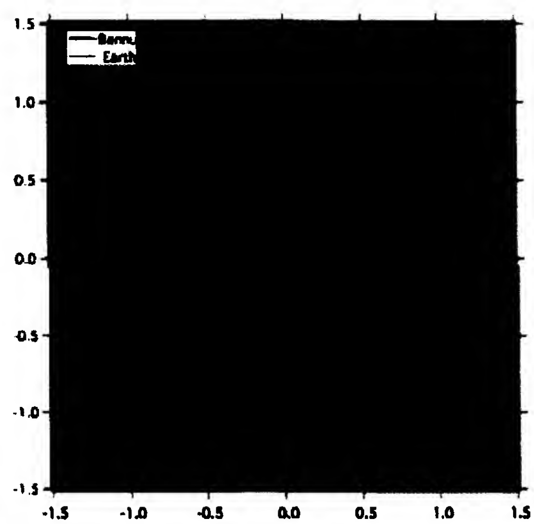
The spectrum suggests Bennu is a CI (<125-μm) or CM (100-200-μm) type carbonaceous chondrite. The composition is important for predicting the proper standoff distance for a nuclear deflection. The hydrogen present in a carbonaceous chondrite permits deeper penetration of X-rays than would occur in a more common type of chondrite. Further, the density of the base material is near 2.24 if it is like Ivuna and Orguei, and 2.70 if it is like Mighei, so a bulk density near 1 g/cc shows Bennu to have a very high macro-porosity, a characteristic that adds uncertainty to most mitigation methods.

The Orbit:

The orbit is very well determined based on 9 radar delay, and 4 Doppler measurements, as well as 282 optical observations spanning 2448.8 days (1999-Sep-11.4 to 2006-May-26.2

e	0.2037451402075473	+/- 2.1411e-08
A(AU)	1.126391025968665	+/- 4.1321e-11
i	6.034935360119198°	+/- 2.775e-06°
W	2.060867236501382°	+/- 4.209e-06°
w	66.22307751279737°	+/- 4.876e-06°
Ma	101.7039436661633°	+/- 2.325e-06°
tp	2455439.1419509717	
P	436.64872815	+/- 2.40e-08 d
n	0.8244613502509457°/d	+/- 4.53e-11°/d

It has a semi-major axis near that of earth, with modest eccentricity and inclinations. When the earth pass such an object, with relatively earthlike orbit, the relative speed is low (6.34 km/s), and a gravitational impact parameter large (2.8 earth radii). The orbits do not intersect, but the minimum orbit intercept distance (MOID) is only 0.00322279 AU, a bit more than a lunar distance, or 75 earth radii.



US-RUSSIAN ASTEROID DEFLECTION TEST PROBLEM #1 (TP1)

Aaron R. Miles

Lawrence Livermore National Laboratory

March 20, 2014

The goal of Asteroid Deflection TP1 is to calculate the deflection velocity for a 2D test object, using various energy sources. Test Problem 1n (TP1n) uses a standoff neutron source, TP1x uses a standoff x-ray source, and TP1i uses a kinetic impactor. Nuclear sources are compared across of range of yields from 20KT-1MT. The neutron case compares the effect of higher energy neutrons vs. lower energy neutrons, and the x-ray case compares the effect of a warmer spectrum to a cooler spectrum. The kinetic impactor case includes two different impactor energies, corresponding to kinetic energies of 0.04 and 0.4 KT TNT equivalent.

Target asteroid (Based on Bennu/1999 RO_{36})

Spherical, non-rotating

Diameter = 500 m

Composition: SiO_2

Porosity: 0

Density: 1.5 g/cm^3

Strength: None

EOS: ANEOS, with minimum pressure = 0

Source

- Nuclear
  - Standoff Distance = 100 m
  - Yield = {20, 100, 240, 440, 700, 1000} KT
  - Mono-energetic neutrons (TP1n)
    - 9 MeV
    - 4 MeV
  - Plankian x-ray spectra (TP1x)
    - 8 keV
    - 4 keV
- Kinetic impactor (TP1i)
  - Impact speed 20 km/s:

- Mass
  - 1 ton (Kinetic energy KE = 0.04 KT)
  - 10 ton (KE = 0.4 KT)

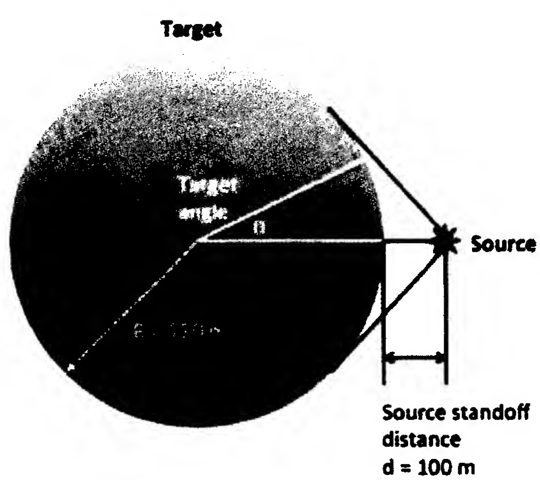
Key metric

- Nuclear deflection: Deflection velocity at 5 milliseconds (ms), defined as z-component of blow-off momentum divided by total (initial) asteroid mass
- Kinetic impactor: Momentum multiplication factor β

Other reportables

- Detail energy deposition approach
- Deposition profiles
  - Defined as (Energy deposited)/(Volume)/(Source Yield)
  - Units: erg/cm^3/KT
  - Include six orders of magnitude in plots
  - Deposition vs. depth at various target angles: 0°, 10°, 20°, 30°, 35°, 40°, 42.4°
  - Deposition vs. angle at various target depths:
    - Neutrons: 0 cm, 1 cm, 10 cm , 100 cm
    - X-rays: 0 cm, 0.001 cm, 0.01cm, 0.1cm, 1cm, 10cm
- Describe equation of state used (if other than ANEOS)
- Show time dependence of deflection velocity metric
- Show meshing scheme and resolution
- Demonstrate convergence
- 1D planar on-axis results

Problem geometry



Department of Energy
National Nuclear Security Administration
Washington, DC 20585

May 1, 2014

MEMORANDUM FOR DISTRIBUTION

FROM: DONALD L. COOK
DEPUTY ADMINISTRATOR
FOR DEFENSE PROGRAMS

SUBJECT: Finding Flexibility in Site Budgets to Support Planetary Defense Initiative

ISSUE: I am asking the three laboratories to develop a coordinated problem statement that defines the parameters of the Planetary Defense Program Case Study 1 and for each laboratory to review their Research, Development, Test and Evaluation portfolios and recommend scope adjustments to meet the Case Study 1 initiative.

BACKGROUND: The National Nuclear Security Administration (NNSA) has responded to NASA's Asteroid Grand Challenge, which is an ambitious, large-scale national goal that encourages multi-disciplinary collaborations and demands advances in innovation, science and technology. Not only does NNSA have a possible role in mitigation by deflecting a potentially hazardous object, but our ground coupling expertise and computing capabilities are integral to any national or global response. Our planetary defense goals are consistent with NNSA's national security mission.

We recently established goals with NASA during workshops held on January 29, 2014, at the Goddard Space flight Center. Further, I am committed to a dialogue in the international community, specifically Russia on mutual scientific advancements. To meet our goals, I ask you to propose a problem statement with associated scope that fully defines Case Study 1 and review your portfolios and recommend scope adjustments to allocate a site specific FTE effort for the Case Study 1 initiative.

In developing the problem statement and associated scope, recall that Case Study 1 will model the mitigation of an asteroid for kinetic impact, a nuclear stand-off detonation, and a nuclear surface detonation. Further analysis will involve an earth impact comparison of the asteroid with a one tenth of one percent fragment. A final joint NNSA/NASA report should be provided within 18 months of initiating the project and submitted for publication.

My program manager for this effort is Dr. Kevin Greenaugh, and his action officer is COL Daniel Zalewski. Please provide your options to them by June 3, 2014 to facilitate our analysis with NASA and prepare for an exchange with Russian designers this Fall.

cc: Kevin Greenaugh, Planetary Defense Program Manager
COL Daniel Zalewski, NA-19
CDR Andrew Urbanski, NA-122
Bret Fitzgerald, NA-122

DISTRIBUTION:

Keith LeChien
Acting Assistant Deputy Administrator,
Research, Development, Test and Evaluation

Craig Leisure
Associate Director, Los Alamos National Laboratory

Charles Verdon
Associates Director, Lawrence Livermore National Laboratory

Jerry McDowell
Associate Director, Sandia National Laboratories

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

JUL 0 9 2015

MEMORANDUM FOR GEOFFREY L. BEAUSOLEIL
MANAGER
NNSA PRODUCTION OFFICE

FROM: WILLIAM S. GOODRUM
ASSISTANT DEPUTY ADMINISTRATOR
FOR STOCKPILE MANAGEMENT

SUBJECT: W71 Canned Subassembly (CSA)

The Office of Nuclear Weapon Stockpile worked with the nuclear security enterprise laboratories to assess the feasibility of the subject CSA for an improbable planetary defense mitigation mission. Considering the nature of the threat, the progression of National Aeronautics and Space Administration asteroid surveys, the capabilities of current stockpile devices, the availability of alternative strategies, and considerations of overall mission reliability, the assessment concluded there is little gained by the potential use of the W71 for planetary defense purposes.

Therefore, please direct Consolidated Nuclear Security (CNS), LLC to:

1. Update existing dismantlement plans to include the W71 CSA;

2. Coordinate with Lawrence Livermore National Laboratory on an archiving strategy to record data during W71 CSA dismantlement; and

3. Address life extension program material needs for recovered W71 material.

Please provide a copy of the plan by November 15, 2015. Should you have any questions, you may reach me at telephone (202) 586-4879.

cc: K. Greenaugh, NA-10.1
R. Lewis, NA-12
A. Urbanski, NA-12
J. Gazda, NA-122
L. Barela, NA-122.1
A. Felser, NA-122.1
T. Driscoll, NA-193
N. Nelson-Jean, LFO
D. Wapman, LLNL
P. Miller, LLNL
B. Gullet, CNS/Y-12
B. Scott, CNS/Y-12
R. Collier, NPO
M. Padilla, NPO

Department of Energy
National Nuclear Security Administration
Production Office

P.O. Box 2050
Oak Ridge, TN 37831

P.O. Box 30030
Amarillo, TX 79120

July 29, 2015

Mr. Colby C. Yeary
Director, Stockpile Programs
Program Integration
Consolidated Nuclear Security, LLC
P.O. Box 30020
Amarillo, Texas 79120

Dear Mr. Yeary:

W71 CANNED SUBASSEMBLY (CSA)

Reference: Memorandum from William S. Goodrum to Geoffrey L. Beausoleil, *W71 Canned Subassembly*, dated July 9, 2015

NPO has reviewed the subject request, and CNS is authorized to perform the work specified in the referenced memorandum. Please provide a briefing for NPO and a copy of the requested Plan no later than November 5, 2015.

The actions taken herein are considered to be within the scope of this contract and do not authorize Consolidated Nuclear Security, LLC (CNS) to incur any additional costs (either direct or indirect) or delay delivery to the Government. If CNS determines that carrying out these actions will increase contract costs or delay any delivery, CNS will verbally and by email notify the Contracting Officer (CO) as soon as possible and then will notify the CO in writing of the potential impact(s) within 30 days from the receipt of this letter. After CNS gives its written notification of the impact(s), CNS will await further direction from the CO.

If you have any questions, please contact Rick Collier at NPO Y-12 at rick.collier@npo.doe.gov or (865) 576-9254.

Sincerely,

Jill Y. Allbaugh

Jill Y. Allbaugh
Contracting Officer

Enclosure: As stated

cc:
L. Barela, NA-122.1, ABQ
T. Driscoll, NA-193, FORS
B. Edlund, NPO-70
D. Beck, CNS Y-12
B. Gullet, CNS Y-12

COR-NPO-70 PP-7.30.2015-635815